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PINE BEETLE HAZARD CONDITIONS  
ON THE  
SISTERS AREA OF THE DESCHUTES NATIONAL FOREST

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May 1945

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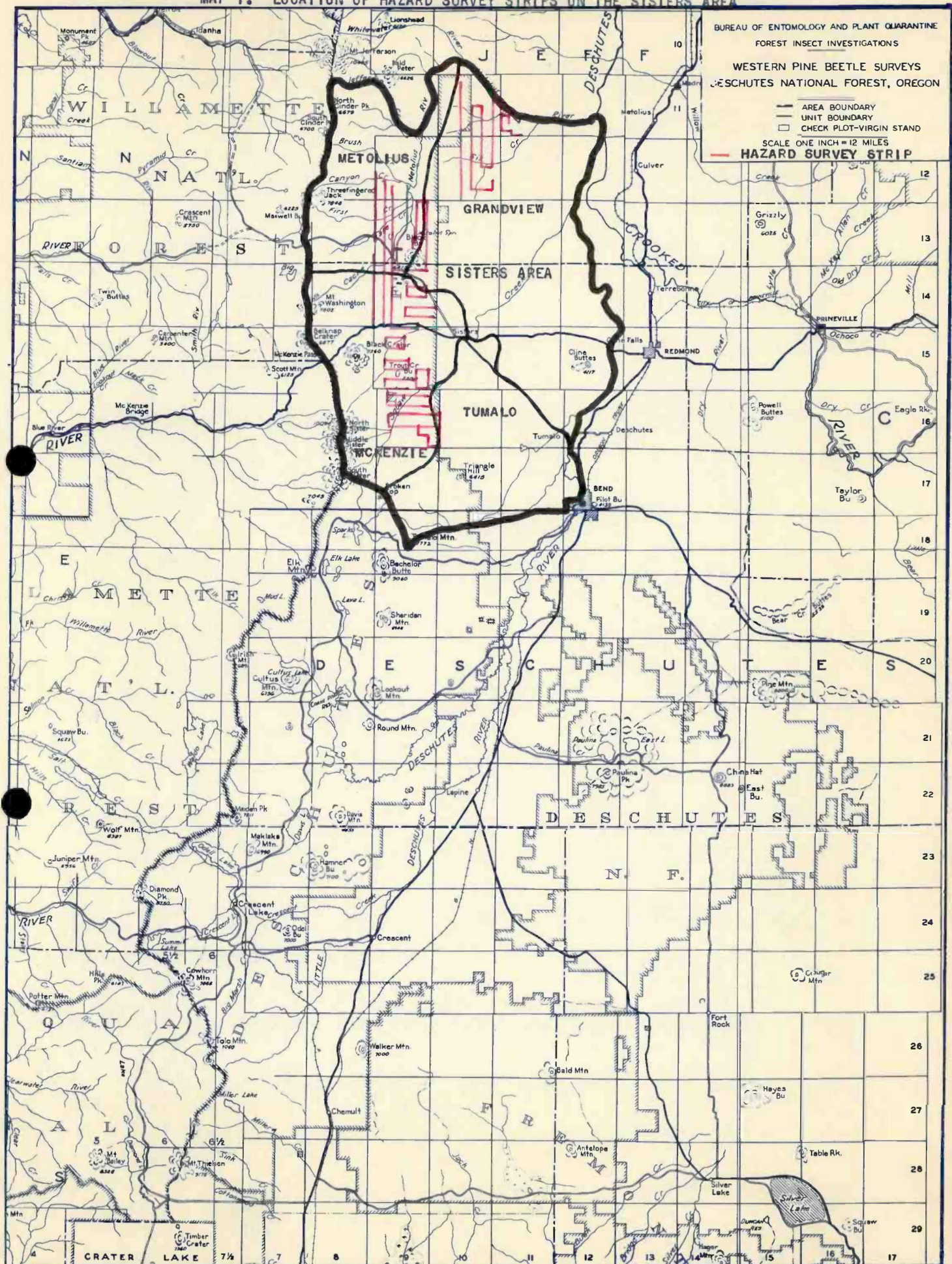


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MAP I. LOCATION OF HAZARD SURVEY STRIPS ON THE SISTERS AREA





## INTRODUCTION

The role of bark beetles, particularly the western pine beetle (*Dendroctonus brevicornis* Lec.), as a primary factor in the destruction of valuable ponderosa pine forests is all too well known. It is generally agreed that, until recurring mortality caused by these pests has been greatly reduced, there is little hope of sustained production of ponderosa pine. The prevention and control of epidemic outbreaks of these beetles has been the major research project of the western forest insect laboratories of the Bureau of Entomology and Plant Quarantine for a long time. During recent years, encouraging progress has been made toward the solution of this important problem.

One of the most promising leads in the prevention of these epidemics is a method of "bug-proofing" a stand or forest. This is accomplished by removing - through light cutting or sanitation-salvage logging operations - those trees which are known to be susceptible to insect attack and which are most likely to be attacked in the near future. Such a cut removes a small percentage of the stand volume (the high-risk and usually high value trees) that would normally succumb to beetle attacks before regular logging operations reached the stand. At the same time, the stand is left in a healthy, vigorous condition. This method which was developed from experimental work in Northeastern California <sup>6/</sup> has already been tested by private companies and federal land-managing agencies in California, Oregon and Washington. To date, the results of most of these operations have been most gratifying.

It is estimated that there are approximately 5,800,000 acres of commercially valuable ponderosa pine in Oregon and Washington in need of some form of light selection cutting prior to normal operations. Such action is essential if existing values are to be utilized. However, during these war years, it is impossible to institute a program of sanitation-salvage logging commensurate with the needs of the region. As a post-war undertaking, it should have high priority in all pine management plans.

Before any program of "beetle-proofing" a stand or a forest can be initiated, it is necessary to know the relative hazard of that stand to insect attack. Information of this nature should be helpful to foresters in directing logging operations into the most hazardous areas in order to utilize present values. This type of data is best obtained from a hazard survey designed to determine the proportion of the stand most susceptible to high future insect-caused losses.

It is the purpose of this report to summarize the results of an experimental hazard survey, conducted during the summer of 1944, to rate the virgin stands of the Sisters Area of the Deschutes National Forest, Oregon according to their hazard from insect attack and to indicate the areas in need of sanitation-salvage cuttings.



## PREVIOUS INVESTIGATIONS

For many years forest entomologists have recognized that ponderosa pine stands vary in their susceptibility to bark beetle attack, but it was not until 1937 that this idea was crystalized into the making of the first bark beetle hazard surveys of forested areas in north-eastern California 5/. In this project some 2, 300,000 acres were intensively covered during a three-year period and the relative hazard of pine stands grouped into five broad classes. Ratings were based principally on two factors - (1) the percentage of pine volume killed in the past 12 to 15 years and (2) the percentage of high-risk volume still remaining in the reserve stands.

Subsequent to this California survey, a preliminary hazard appraisal was made by Keen in 1939 2/ of the Klamath Subregion of Oregon on the basis of data compiled from previous insect loss and timber resource surveys.

In 1941, Keen 3/ made a similar study of the Deschutes Subregion in which pine beetle hazard was determined by a combination of the following factors: forest type, site quality, elevation, volume per acre, and actual pine beetle losses during the previous 10-20 year period. A hazard zonation map was prepared which indicated the probable future hazard of the stands in the subregion during the next 10-20 years. On the Sisters Area, the largest block of high hazard timber was found to be in Ranges 10 and 11 East, Townships 11 to 17 inclusive. It was recommended that, while logging operations were progressing at a fairly rapid rate in this area, a sanitation-salvage cut of 15-20 percent of the stand volume in advance of the main logging job would save a great deal of valuable timber in the Sisters Area.

## 1944 HAZARD SURVEY OF THE SISTERS AREA

### Why the Survey Was Undertaken

Although it was impossible to start a comprehensive hazard survey of all the ponderosa pine forests of Oregon and Washington at the present time, there was an immediate need for information on pine beetle hazard on some of the important working circles of the region. In June 1944, the opinions of the Western Pine Association, Forest Service and Indian Service were solicited to determine the areas, administered by each agency, on which such data would be most useful. As a result of these conferences, the Sisters Area of the Deschutes National Forest was one of three areas selected for experimental hazard surveys during the summer of 1944.

The hazard survey of the Sisters Area was undertaken primarily to meet two needs: the need of land-managing agencies for immediate data on pine beetle hazard and our desire to know what could be accomplished with a small force in a short period of time.



### Objectives of the Survey

The specific objectives of the hazard survey on the remaining virgin stands of ponderosa pine of the Sisters Area were as follows:

- (1) To try one method - the ground strip and quarter-acre sample plot - of securing data on pine beetle hazard conditions with a small crew working on one area for a limited period.
- (2) To secure data on past insect-caused losses as a supplement to existing survey records.
- (3) To secure data on probable future losses by determining the proportion of trees in the present stand that are highly susceptible to insect attack.
- (4) To classify the stands of the area according to their relative hazard from insect attack.
- (5) To prepare a hazard zonation map that might be useful in considering future forest management plans for the Sisters Area.

### Accomplishments of the Survey

As shown on map 1, the actual sampling of the Sisters Area during the hazard survey was confined to a relatively small portion of the area. Most of the survey strips were run in Range 9 East, Townships 12-16 South; the remainder were in T. 10 S., T. 11, 12 S., and R. 11 E., T. 11 S.

The field work on the survey was completed in 11 days during the period from August 1 to 17, 1944 by R. L. Furniss, W. J. Buckhorn, and the writer of the Portland Forest Insect Laboratory. Mr. A. J. Jaenicks of the Forest Service assisted with the field work during part of the first week.

The physical accomplishments of the survey may be summarized as follows:

Man-days of field work	26	days
Miles of strip	161.5	miles
Miles of strip per man-day	6.2	miles
Acreage of quarter-acre line plots	619.25	acres
Number of trees classified as to risk	19,162	trees
Volume of trees classified as to risk	13,285,000	board feet
Number of snags tallied	3,046	snags
Volume of snags tallied	2,288,000	board feet



## DESCRIPTION OF THE SISTERS AREA

For all practical purposes, the Sisters Area of this report corresponds to the Sisters Working Circle and the Sisters Ranger District of the Forest Service. The reporting area shown in map 1 is almost equally divided between Jefferson and Deschutes Counties and includes all ponderosa pine timberlands irrespective of ownership.

The Sisters Area occupies 30 percent of the pine acreage of the Deschutes National Forest. It is an area of rather high elevation, ranging from 3,000 feet on the Metolius River to 10,354 feet at the summit of the South Sister Mountain. All of the drainage of the area is into the Deschutes River. The soil is a loose pumice type. Extensive lava outcrops and cinder cones or buttes are common along the east slopes of the Cascade Range. It is an area of many uses, particularly recreation, with the Metolius River and Suttle Lake recreation areas being among the most popular in the state.

For reporting insect-caused losses during the regional bark beetle survey project, the Sisters Area has been divided along more or less natural topographic lines into four entomological or infestation units (map 1). The approximate acreage and volume of ponderosa pine on these four units, computed from the Forest Service Resource Survey data (1, 4) and corrected to January 1, 1944, are as follows:

### Ponderosa Pine Resources (January 1, 1944)

<u>Unit</u>	<u>Acreage</u>		<u>Total</u>	<u>Virgin Pine Volume Board Feet</u>
	<u>Virgin</u>	<u>Cutover</u>		
Grandview	66,000	53,000	119,000	900,000,000
Metolius	69,000	1,000	70,000	790,000,000
McKenzie	64,000	16,000	80,000	1,150,000,000
Tumalo	17,000	54,000	71,000	260,000,000
Total	216,000	124,000	340,000	3,100,000,000

On a volume basis, the ownership of ponderosa pine in the Sisters Area in 1935 (1, 4) was as follows:

<u>Ownership Class</u>	<u>Percentage of Ponderosa Pine Volume</u>
Private	53.7
National Forest	45.0
Other Federal	1.0
State	0.1
County	0.2
Total	100 percent



The National Forest lands in the Sisters Area are administered by the Deschutes National Forest. The largest private owner in the area is the Brooks Scanlon Lumber Company. During recent years, privately owned timber, especially in the Tumalo and Grandview Units has been cut at a fairly rapid rate. As a result of land exchange agreements, the Forest Service has acquired a considerable acreage of this cutover ponderosa pine lands.

The timber from the Sisters Area is cut in four mills: at the Hitchcock and Spoo mills in Sisters, at the Titeknot mill in Redmond, and at the Brooks Scanlon mill in Bend. The latter mill, being the largest, is converting most of the timber from the Sisters Area.

#### HAZARD SURVEY METHODS ON THE SISTERS AREA

Before the actual field work began, a forest type map of the area was brought up to date. All cutover lands were located on a 1/2 inch scale map and all sections scheduled for cutting within one or two years were plotted on an overlay sheet. Thus, the portion of the area to be sampled could be easily delineated and the project narrowed considerably.

#### Survey Procedure

All data were taken on quarter-acre circular plots. One plot was established and cruised every tally (330 feet) along a line, which usually followed a section line and which usually started at a section or quarter-corner. A total of 16 plots or four acres of ponderosa pine were cruised per mile of strip with the data from four plots tallied together to make four samples in each mile. For the most part, the strips were run north and south so as to cross as many drainages as possible. Distances were paced and when blazed section lines could not be followed, the lines were run with a box compass.

On each plot, two indices of bark beetle hazard were recorded: (1) the past 10-12 years mortality, as represented by standing snags, and (2) the probable future loss, as represented by those green trees showing signs of deterioration or susceptibility to insect attack in the near future. All trees and snags above 11.5 inches in diameter were recorded by two inch diameter classes. All volumes were computed from an average site quality IV volume table previously prepared by the laboratory.

#### Risk Classes

For the first few miles of strip, the green trees were classified according to the California four-class system of rating tree risk. However, greater refinement of definition appeared desirable and hence



Keen's unpublished penalty system of rating current health was used on practically all plots. This latter system penalizes each tree on a point basis. Current symptoms of poor health are taken into consideration according to the following criteria: unhealthy crown condition, 0 to 4 points; poor needle condition, 0 to 4 points; and weakness or injury, 0 to 8 points. Under this system, the risk of individual trees to insect attack is determined by adding the penalties against it. Thus, a minimum of 0 points and a maximum of 16 points can be counted against each tree.

In recording the field data, all green ponderosa pines falling within the limits of the sample plots were tallied in one of two groups: (1) those trees with a penalty of 0 to 4 points, which were considered as representing the low risk element in the stand, and (2) those with a penalty score of 5 to 16 points, which were considered as representing the high risk element in the stand. It is these latter trees that demand immediate attention and are the trees that should be cut under the sanitation-salvage system of logging.

#### Hazard Classes

In order to classify the remaining virgin stands of ponderosa pine in the Sisters Area, according to their relative degree of hazard from insect attack, five classes or degrees of hazard were used. These classes, which were based on the percentage of high-risk volume in the present stand, may be briefly described as follows:

<u>Hazard Class</u>	<u>Map Color</u>	<u>Percent of High-Risk Volume in Present Stand</u>	<u>Remarks</u>
I Very Low	Blue	0-4	Depletion none. Losses negligible.
II Low	Green	5-9	Depletion light. Losses balanced by growth.
III Moderate	Yellow	10-17	Depletion moderate. Losses moderate and expected to continue from frequent and heavy infestations.
IV High	Orange	18-26	Depletion heavy. Losses expected to continue on a large scale.
V Very High	Red	Over 26	Depletion severe. Remainder of stand threatened by expected heavy beetle activity.

#### Preparation of the Hazard Zonation Map

Because our surveys did not sample every section of virgin ponderosa pine in the Sisters Area, it was necessary to rely on past reports and records for clues as to the hazard in some portions of the area.



Thus it is evident that the hazard classification developed from this survey is merely an indication of the probable condition on the Sisters Area.

Although both past insect-caused losses, in the form of standing snags, and future losses, in the form of high risk trees, were measured on the line plots, primary consideration was given to the percentage of high risk volume in the present stand in preparing the hazard map. The percentage of high risk volume obtained from four quarter-acre plots was plotted on a vellum over a forest type map according to the color of the hazard class it represented. Temporary lines were then drawn around like colors. The final hazard boundary was drawn after considering the severity of past losses, topography, forest type, and our knowledge of the Sisters Area as a whole.

#### RESULTS OF THE HAZARD SURVEY

The results of the 1944 hazard survey on the Sisters Area will be briefly discussed first for the area as a whole and then by the four infestation units within the area.

##### Past Losses on the Area

Ponderosa pine mortality on the Sisters Area has been under detailed observation since 1932. Annual cruises have been made on a series of semi-permanent 320 acre check plots which serve as a basis for following pine beetle infestation trends and determining the need for direct control work. During recent years the number of plots has been reduced to seven. A summary of the average losses per acre per year on these seven plots is given in table 1.

As shown in table 1, actual losses in separated parts of the area have varied considerably; however, when compared with some of the other areas in Oregon and Washington, the losses on the Sisters Area have remained at a fairly high level for many years. Although past losses will be discussed in more detail by infestation units, it is evident that very heavy mortality has occurred and is still occurring in the southern portion of the Grandview Unit and in the Tumalo Unit. Losses on the rest of the forest have been correspondingly light.

The data on past mortality taken during the hazard survey substantiated the check plot records. Heavy past losses were found over most of the Grandview Unit, while lighter losses were found on the rest of the forest. A summary of the snag counts made on the quarter-acre sample plots is given in table 2.

##### Future Losses on the Area

The final product, and the ultimate objective of the hazard survey, was the zonation of the remaining virgin stands of ponderosa



pine according to their relative hazard from insect attack. This classification is best shown by the hazard zonation map.

A summary of the number and volume of high risk trees on which future losses are based, as found on the quarter-acre sample plots of the survey, is given in table 3.

The hazard classification of the virgin stands of ponderosa pine in the Sisters Area is shown by the four infestation units in table 4. The distribution of the five hazard classes is as follows:

<u>Hazard Class</u>	<u>Acres</u>	<u>Percent of Remaining Virgin Pine Acreage</u>
I Very Low	12,400	5.8
II Low	50,500	23.4
III Moderate	55,000	25.4
IV High	42,400	19.6
V Very High	<u>55,700</u>	<u>25.8</u>
Total	216,000	100

Over 45 percent or 98,100 acres of the remaining virgin stands on the Sisters Area are considered to be in a highly hazardous condition. Nearly 26 percent of the area is in an extremely critical condition and in need of immediate attention - if excessive ponderosa pine depletion is to be prevented. As indicated by the portions of the hazard map colored in red, there are five major problem areas of very high hazard timber on the Sisters Area. These will be discussed by infestation units in the following sections.

#### Hazard Conditions on the Grandview Unit

Because nearly half of the Grandview Unit has been cutover, the hazard survey was confined to the timber stands in two townships in the northern portion of the unit.

#### Past Losses

Over most of the Grandview Unit, ponderosa pine mortality has been high; on the southern portion of the unit it has been very heavy during recent years. The following records of the Squaw Ridge and Prairie Farm check plots are probably indicative of recent conditions in their respective portions of the unit:

<u>Check Plot</u>	<u>Years</u>	<u>Losses Per Acre Per Year</u>	<u>Percent of</u>
		<u>Trees</u>	<u>Volume (Bd. Ft.) Original Stand Killed</u>
Squaw Ridge	1935-1943	0.67	26.0
Prairie Farm	1937-1943	0.16	6.5



The trend of the infestation on and adjacent to the Squaw Ridge plot seems to have been influenced by the cutting that has taken place around this section. While losses in the vicinity of the Prairie Farm plot are high, the condition is not as serious as it is in the southern portion of the unit.

#### Future Losses

The acreage of high and low hazard timber in the Grandview Unit as determined by the hazard survey is as follows:

<u>Hazard Rating</u>	<u>Acres</u>	<u>Percent of Unit Acreage</u>
II Low	3,500	5
III Moderate	14,500	22
IV High	15,000	23
V Very High	<u>33,000</u>	<u>50</u>
Total	66,000	100

Approximately three-fourths of the remaining virgin stands in this unit are highly susceptible to excessive pine beetle losses; half of the unit is believed to be in a critical condition. On some sections of this unit, bark beetles have depleted the stand to a point where sanitation-salvage logging, for the purpose of reducing insect losses, is no longer feasible. On these sections it would be impractical to mark 'leave trees' and a utilization cut is needed in order to conserve the remaining values.

As indicated by the hazard map, a large percentage of high risk trees was found in three portions of the unit: (1) in the remaining virgin stands in Township 13 South, Range 10 East and in the Fly Creek drainage, (2) in the Six Creek drainage, and (3) in the Street Creek and Spring Creek drainages.

#### Recommendations

Two recommendations are offered for the treatment of the pine stands in this unit:

(1) Immediate attention should be given to the federal and privately owned virgin stands in Township 13 South, Range 10 East and in portions of the Fly Creek drainage. Pine beetles are taking a heavy toll of valuable timber in most of the sections; if the remaining values are to be utilized, most of this portion of the unit should be cutover at once. Because of the heavy past losses, a utilization cut would be



advisable in the remaining sections of this township.

(2) As soon as possible, cutting on a sanitation-salvage basis should be started in the remaining virgin stands of the unit, especially in the Six Creek, Street Creek and Spring Creek drainages.

#### Hazard Conditions on the Metolius Unit

The hazard survey covered a large portion of the commercially valuable stands in the Metolius Unit. As shown on the hazard map only about 1000 acres of this unit have been cutover.

#### Past Losses

Ponderosa pine mortality has been low over most of the Metolius Unit ever since our records began. The records on three check plots in this unit are as follows:

<u>Check Plot</u>	<u>Years</u>	<u>Losses Per Acre Per Year</u>	<u>Percent of</u>
	<u>10</u>	<u>Trees</u>	<u>Volume(Bd.Ft.)</u>
Allingham	1934-1943	0.09	78
	<u>12</u>		
Black Butte	1931-1943	0.12	80
	<u>12</u>		
Jack Creek	1931-1943	0.11	111

A combination of two factors has been responsible for the low endemic condition found on this unit: (1) There is a marked difference in the character of the pine stands of the Metolius Unit, as contrasted with those of the Grandview and Tumalo Units. (2) Four direct control projects during the period 1934-1941 have no doubt helped to keep pine beetle losses low. On these projects, a total of 11,730 trees have been treated by the fell-peel-burn method and most of them have been in the Metolius Unit.

#### Future Losses

The hazard classification of the stands of the Metolius Unit is as follows:

<u>Hazard Rating</u>	<u>Acres</u>	<u>Percent of Unit Acreage</u>
I Very Low	6,000	9
II Low	21,000	30
III Moderate	18,000	26
IV High	16,000	23
V Very High	<u>8,000</u>	<u>12</u>
Total	69,000	100



Slightly more than one-third of the virgin pine acreage of the unit is considered to be highly hazardous to insect attack; twelve percent of the unit is in a critical condition.

Two spots of very high hazard timber were indicated by the survey: (1) on a portion of the Jack Creek drainage, and (2) on a portion of the unit between Metolius River and Green Ridge. In the Jack Creek drainage, steps are already being taken to reduce future losses. Sanitation-salvage logging, as a seasonal project, began during the winter of 1944-1945. The second spot of very high risk timber is in a difficult location. It is on a bench between the Metolius River and Green Ridge and includes a portion of an area having high recreational and ~~summer~~ home value, as well as part of the Metolius Natural Area.

#### Recommendations

(1) Since sanitation-salvage cuttings in the Jack Creek drainage are necessary and are now in progress, it is recommended that the small pocket of high risk timber in this drainage be cut as soon as possible, rather than extend the cutting over several winters.

(2) Because sanitation-salvage cuttings cannot be carried out on the Metolius Natural Area and are probably not feasible in the adjoining recreational area, it is recommended that the stands in this second spot of high risk timber be watched for signs of rising beetle losses. If direct control measures are necessary, they should be undertaken to check incipient outbreaks.

#### Hazard Conditions on the McKenzie Unit

Although the hazard survey strips were run only in Range 9, it is believed that a fair picture of the conditions on the McKenzie Unit was obtained.

#### Past Losses

During the past decade, ponderosa pine mortality over most of this unit has been low to moderate in intensity. Detailed records of pine beetle activities have been kept on one 320 acre plot since 1934. The average losses on this plot are as follows:

<u>Check Plot</u>	<u>Years</u>	<u>Losses Per Acre Per Year</u>		<u>Percent of Original Stand Killed</u>
		<u>Trees</u>	<u>Volume(Bd. Ft.)</u>	
Cold Spring	<sup>10</sup> 1934-1943	0.17	111	6.5

It is felt that the above record represents the condition on most of the mature ponderosa pine stands in this unit.



### Future Losses

The remaining pine stands on the McKenzie Unit have been divided into the following hazard classes:

<u>Hazard Rating</u>	<u>Acres</u>	<u>Percent of Unit Acreage</u>
I Very Low	6,400	10
II Low	26,000	41
III Moderate	19,000	30
IV High	11,400	18
V Very High	<u>1,200</u>	<u>1</u>
Total	64,000	100

When compared to the other units of the Sisters Area, the McKenzie Unit contains the smallest amount of high hazard timber. Only 19 percent of the unit, or 12,600 acres, were found to be in need of immediate attention. One percent of the unit was rated in the very high hazard class.

### Recommendations

It is recommended that sanitation-salvage cuttings be initiated as soon as possible in two portions of the unit (the portions shown in red and orange on the map).

(1) In the sections surrounding Melvin and Three Creek Buttes and in the lower portion of the Squaw Creek drainage, east of Brush Draw.

(2) Along each side of the old and new Santiam highways from Sisters to Black Butte swamp. Although this situation is not pressing, a very light cut in these few sections would salvage considerable high risk, high quality timber and at the same time improve the scenic value of this important highway.

### Hazard Conditions on the Tumalo Unit

Because most of the Tumalo Unit has been cutover or allocated for cutting, only a very small sector of the unit was included in the survey. However, in making the hazard map, the uncut portion of the unit, scheduled for cutting in the near future, was given a hazard rating.



### Past Losses

Pine beetles have been very active in the Tumalo Unit and over most of the unit have caused heavy losses. The nine year record of the Melvin Butte check plot is probably typical of recent losses on the mature stands of the unit:

<u>Check Plot</u>	<u>Years</u>	<u>Trees</u>	<u>Losses Per Acre per Yr.</u> <u>Volume (Bd. Ft. )</u>	<u>Percent of</u> <u>Original Stand Killed</u>
	9			
Melvin Butte	1935-1943	0.31	204	15.4

### Future Losses

The probable hazard rating of the remaining virgin stands of the Tumalo Unit is as follows:

<u>Hazard Rating</u>	<u>Acres</u>	<u>Percent of Unit Acreage</u>
III Moderate	3,500	20
V Very High	<u>13,500</u>	<u>80</u>
Total	17,000	100

As shown by the above classification, and by the red areas on the hazard map, all of the remaining virgin stands of commercial importance are in need of immediate attention if serious and continued depletion is to be avoided.

### Recommendations

It is recommended that sanitation-salvage operations be started at once in the remaining virgin stands of this unit. With Brooks Scanlon Lumber Company already operating in the vicinity of Three Creek Butte, it should be possible to cover the rest of the Tumalo Unit, as well as the adjoining sections of the McKenzie Unit, in a short period.

### CONCLUSIONS

As a result of the field study during the summer of 1944, two conclusions can be drawn:

First - Because of the nature of the survey, it was impossible to establish definite boundaries between the five classes of hazard. The zonation of the remaining virgin stands of ponderosa pine on the Sisters Area according to their relative hazard from insect attack, as given in this report, is intended to serve only as an indication of probable future conditions. However, it is felt that the stands needing immediate attention from a hazard standpoint have been fairly well defined.



If a utilization cut can be made in the remaining virgin stands in T. 13 S., R. 10 E. and if sanitation-salvage operations can be initiated at once in the areas shown in red on the hazard map, much valuable timber can be utilized before it is wasted by bark beetles.

Second - The ground strip - quarter acre sample plot method, as used in this experiment, is not the best procedure for making hazard surveys under existing conditions; especially when strips are run once through a section. This method yields only a minimum of essential data on which to base estimates of relative hazard from insect attack. It is also too time-consuming to be a practical method on other areas in the region at the present time. Possibly the combination of a road strip and ground strip cruise would enable us to cover an area faster and more accurately - the former to be used in quickly covering a large portion of the area and the latter to be used in obtaining data on obscured portions of the area or areas of suspected high hazard timber.

#### SUMMARY

The results of a seventeen day field survey to rate the remaining virgin stands of ponderosa pine on the Sisters Area of the Deschutes National Forest according to their relative hazard from insect attack are reported.

Field data were taken on quarter-acre sample plots established each 330 feet along section lines. Sixteen plots or four acres of pine were cruised per mile of strip.

All ponderosa pine snags and green trees above 11.5 inches DBH falling within the plots were tallied. The green trees were classified according to Keen's unpublished penalty system of rating current health. Trees with a total penalty score of 0 to 4 points were classified as low risk and those with a score of 5 to 16 points were considered as being the high risk element of the stand.

A hazard zonation map based on five classes of hazard was prepared. The acreage and percentage of the Sisters Area in these five classes of hazard are as follows:

<u>Hazard Class</u>	<u>Acres</u>	<u>Percent of Virgin Acreage</u>
I Very Low	12,400	5.8
II Low	50,500	23.4
III Moderate	55,000	25.4
IV High	42,400	19.6
V Very High	<u>55,700</u>	<u>25.8</u>
Total	216,000	100



Five major problem areas of very high hazard timber in need of immediate attention were indicated by the survey. These areas and recommendations for their treatment are as follows:

- (1) T. 13 S., R. 10 E. - A utilization cut should be made immediately on all remaining virgin stands.
- (2) T. 16 S., R. 10 E. - Sanitation-salvage operations should be initiated at once on the remaining virgin stands.
- (3) T. 11, 12, S. R. 10 E - Sanitation-salvage cuttings should be started as soon as possible in the Fly Creek, Six Creek, Spring Creek and Street Creek drainages.
- (4) T. 12, 13 S., R. 9 E - A sanitation-salvage operation is under way in the Jack Creek drainage on a seasonal basis. The small pocket of very high hazard timber should be cut as soon as possible.
- (5) T. 12, 13 S., R. 9 E. - Direct control operations are probably all that can be undertaken in the narrow strip of very high hazard timber between Metolius River and Green Ridge.



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Table 1. Ponderosa pine mortality on 320 acre  
check plots in the Sisters Area,  
Deschutes National Forest.

Unit	Check Plot	Years	Losses Per Acre Per Yr.		Percent of original stand killed
			<u>Trees</u>	<u>Volume</u>	
Grandview	Squaw Ridge	<u>2</u>			
	T13S, R10E, Sec 27 E/2	1935-1943	0.67	290	26.0
	Prairie Farm	<u>7</u>			
Metolius	T12S, R10E, Sec 33 E/2	1937-1943	0.16	145	6.5
	Allingham	<u>10</u>			
	T12S, R9E, Sec 35 W/2	1934-1943	0.09	78	5.0
Metolius	Jack Creek	<u>13</u>			
	T13S, R9E, Sec 5 E/2	1931-1943	0.11	111	7.2
	Black Butte	<u>13</u>			
McKenzie	T13S, R9E, Sec 29 E/2	1931-1943	0.12	80	3.7
	Cold Spring	<u>10</u>			
	T14S, R9E, Sec 34 S/2	1934-1943	0.17	111	6.5
Tumalo	Kelvin Butte	<u>9</u>			
	T16S, R10E, Sec 16 W/2	1935-1943	0.31	204	15.4



Table 2. Number and volume of ponderosa pine snags on quarter-acre sample plots of the hazard survey.

Unit	Acres Cruised	NUMBER OF SNAGS		VOLUME OF SNAGS ( BD. FT. )		
		Total	Per Acre	Total	Per Acre	Percent of stand
Grandview	165.50	855	5.17	611,210	3,693	21
Metolius	174.00	709	4.07	482,570	2,773	11
McKenzie	269.75	1,403	5.30	1,164,390	4,317	13
Tumalo	10.00	52	5.20	29,700	2,970	14
Total	619.25	3,046	4.92	2,287,870	3,695	15



Table 3. Number and volume of high-risk ponderosa pines on the quarter-acre sample plots of the hazard survey.

Unit	Acres Cruised	HIGH RISK TREES		HIGH RISK VOLUME ( BD. FT. )		
		Total	Per Acre	Total	Per Acre	Percent of stand
Grandview	165.50	472	2.85	403,520	2,438	17
Metolius	174.00	500	2.87	422,590	2,429	14
McKenzie	269.75	1,052	3.90	872,830	3,236	11
Turalo	10.00	55	5.50	43,780	4,378	23
Total	619.25	2,079	3.36	1,742,720	2,814	13



Table 4. Summary of the hazard classification of the Sisters Area by infestation units

Unit	Hazard Rating	Acres	% of Unit Acreage	% of Area Acreage
Grandview	II	3,500	5	1.6
	III	14,500	22	6.7
	IV	15,000	23	7.0
	V	<u>33,000</u>	<u>50</u>	<u>15.2</u>
	Total	66,000	100	30.5
Metolius	I	6,000	9	2.8
	II	21,000	30	9.8
	III	18,000	26	8.3
	IV	16,000	23	7.4
	V	<u>8,000</u>	<u>12</u>	<u>3.7</u>
	Total	69,000	100	32.0
McKenzie	I	<u>6,400</u>	<u>10</u>	<u>3.0</u>
	II	26,000	41	12.0
	III	19,000	30	8.8
	IV	11,400	18	5.3
	V	<u>1,200</u>	<u>1</u>	<u>.5</u>
	Total	64,000	100	29.6
Tumalo	III	3,500	20	1.6
	IV	<u>13,500</u>	<u>80</u>	<u>6.3</u>
	Total	17,000	100	7.9
Total		216,000		100
SISTERS	I	12,400		5.8
AREA	II	50,500		23.4
TOTAL	III	55,000		25.4
	IV	42,400		19.6
	V	<u>55,700</u>		<u>25.8</u>
	Total	216,000		100



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